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The Refrigeration Service Engineer

Vol. 4
No. 1

JANUARY • 1936

Servicing Copeland Commercial Equipment
Questions and Answers • Dehydrators • Multiple
Apartment Installations • Service Suggestions

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REFRIGERATION UNITS *and* OIL BURNERS

VOL. 4 JANUARY, 1936 NO. 1

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COVER

HOW one large wholesale parts distributors transfers refrigerants from large drum to service drum.

It is a modern arrangement to transfer the liquid refrigerant with pump. A method of providing a seal for the pump makes this method possible.

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The
Refrigeration
Service Engineer

A Monthly Illustrated Journal Devoted to the Interests of the Refrigeration Service Engineer in the Servicing of Domestic and Small Commercial Refrigeration Systems and Oil Burners

OFFICIAL ORGAN REFRIGERATION SERVICE ENGINEERS' SOCIETY

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Installing and Servicing (2nd Article)

Copeland Commercial Equipment

Additional Information on Water Regulating Valves, Multiple Apartment Installation, Ice Cream Cabinets, Water Coolers and Milk Coolers

AFTER the system has been tested for leaks, attach a dryer and liquid filter to the ¼ in. liquid line from the compressor head with short lengths of ¼ in. tubing. Now, close all suction line shut-off valves on the board, open compressor-suction valve A about half-way, attach a piece of tubing to the B valve and extend the free end into a deep vessel, while operating the compressor in short cycles to evacuate the manifold. Be careful to avoid a rapid evacuation for oil slugging may result. When the vacuum in the manifold reaches 10 lbs., open one of the suction valves on the board slightly and see if this destroys the vacuum. If it does, run the compressor continuously, holding the finger over the end of the ¼ in. liquid line to determine whether the liquid line is open. If no suction is noticed at the end of the liquid line, check for closed valves, plugged line or other obstructions. This test is of value because frequently a portion of the system is sealed off, and the fault is not discovered until after the job is placed in operation. The ¼ in. liquid line leading from the receiver to the valve board with its filter and dryer inserted, is now attached to the liquid receiver, and total evacuation accomplished. This should be done slowly, running a few revolutions at a time.

Referring to Fig. 12, December, 1935, page 16, unit valve D should be closed, E should be partly open and F closed. These positions are needed to evacuate the lines connecting the control compressor and receiver. It is not possible to evacuate the line leading from valve F and the water regulating valve and the high pressure safety bellows of the control. It must be purged instead through the simple process of blowing the air out by admitting refrigerant to take its place. Loosen ¼ in. flare nut at the control and water valve, and open valve F for an instant. A hissing sound is assurance that the air has been replaced with refrigerant. The valve F should now be left completely open, and the flares tested for possible leaks. The switch arm of the pressure control will have to be held down with a small wooden wedge or similar piece of insulating material to keep it from opening the contacts and stopping the unit. Do

not use a piece of metal. The machine can be started and stopped with the main switch above the unit while the evacuation is in progress. When all discharging of air has ceased, remove the oil line from the compressor head. If any oil has accumulated in the bottle, close the A valve and insert the oil line in place of the gauge, drawing the oil back into the crankcase by the suction of the compression. Then replace the gauge and again draw a vacuum in the crankcase to remove any air which may have entered with the oil. Open the A valve and ascertain if the vacuum in the system has been maintained. Sometimes the compressor will continue to discharge vapor for a considerable length of time from the service port of the B valve when evacuating, and this may not necessarily indicate a leak in the system.

Locating Leaks

Generally this prolonged pumping is due to the evacuation of the refrigerant from the compressor oil. To test this, close the A valve and note whether the action stops. This will indicate the source of the air or gas by isolating the crankcase. If the discharge of vapor is found or suspected to be air, and if closing the A valve places the blame on the compressor, stop the machine with the finger, drawing a film of liquid soap over the opening in the B valve. If the discharge valve discs are seating properly, the soap film will remain stationary, but should it be drawn into the valve, the inability to draw a vacuum has been caused by a leakage of air through the discharge valves at intervals between each stroke of the pistons. It will then be necessary to remove the cylinder head and ascertain if small particles of foreign matter are holding one of the discs partly open. It should be remembered that the inches of vacuum as indicated on the compound gauge after evacuating does not truthfully reveal the efficiency of the compressor. Small commercial gauges of the compound type are not accurate enough near the 30 in. point to enable one to make efficiency tests with them. The altitude or height above sea level also has a marked influence on these gauges. It is not advisable to attempt any precise adjustment of expansion valves until the entire system is placed in operation, although some immediate change may be necessary if one of the valves has been moved considerably from the setting established at the factory before shipment. After the complete system is in operation, the correct pressure control at the approximate cut-in and cut-out point can be set.

Setting Pressure Control

The wedge from the pressure control has been removed in order to allow it to function. With the compound gauge inserted in the suction shut-off valve A, the stem is gradually turned in to restrict the flow of refrigerant into the crankcase. The gauge, of course, shows the pressure of the vapor after it is admitted, and this same pressure is acting upon the control which is connected to the opposite side of the crankcase through the valve E. No appreciable drop in pressure is noticed until the A valve is almost entirely closed; then it is reduced quickly. Keep watching the gauge and turn the stem slowly, noting the pressure indicated at the instant the control goes off. For the type of installation discussed in this article, this should be around 10 lbs. To change the cut-out point of the control, turn the large coil spring at the lower part of the housing to relieve or increase tension on the switch mechanism. Repeat the operation and make a further change if necessary, watching cut-out point only. Should the drop in crankcase pressure be too sudden and there is difficulty in taking gauge readings, open the valve A to let the vapor in more rapidly. The cut-in point of the control is equally simple. Close the A valve entirely, operate the compressor until it stops automatically, then open the A valve slightly to allow a vapor pressure to be built up gradually. You will note that the control is cut-in when the insulated link travels to the bottom of the slot in the switch arm. By raising or lowering the bottom or lower limit of the slot, we can change the cut-in point without affecting the cut-out. This makes it possible to widen or narrow the differential. The large coil spring merely adjusts the range, moving both cut-in or cut-out points higher or lower without changing

their relation to each other. The control for this particular installation should be set to cut-in at about 25 lbs., although this may probably have to be changed to suit the existing conditions as well as the cut-out point of 10 lbs. suggested above.

Adjustment of Water Regulating Valve

Since the head pressure rises with insufficient cooling and descends with increased cooling, the water valve should be actuated or controlled by the head pressure. Increase in pressure causes the diaphragm to be depressed, widening the opening in the valve, and the consequent increased flow of water gives the added cooling effect needed. During the idle cycle, the valve is almost completely closed, making it more economical than the fixed flow type. For example, we will take a hypothetical case where it is advantageous to adjust our water regulating valve to maintain an 80 lb. head pressure. The B valve is open a part of a turn to indicate the head or high-side pressure. Be certain that this valve is open. The strokes of the compressor should be plainly noticeable by a slight trembling of the gauge needle. The unit must operate for at least five minutes before any readings can be taken. If the pressure is less than 80 lbs., a little less water will suffice. So, referring to Fig. 13, tighten the adjusting spring A. The nuts B should be turned upward equally in the direction of the diaphragm for a distance of two threads. Check the packing gland nut C to ascertain if it is too tight. This nut can be tightened sufficiently with the fingers to withstand the low water pressure at that point. The push rod D must be free to move up and down in order to transmit motion from the diaphragm to the valve opening. Start the unit again and observe the head pressure. Should it rise higher than the 80 lbs. we have devided upon, the nuts B can be lowered away from the diaphragm to reduce the spring pressure and increase the flow of water. Under ordinary conditions, the inlet water enters at 60° and is exhausted or discharged at approximately 80°, a rise of 20°. This cannot be accepted as a definite rule, as the water supply in various localities will make it necessary to experiment to find the ideal adjustment. In extremely warm climates, the water supply often reaches 90°. Let us assume that we wish to keep our head pressure down to 80 lbs., as we did in the case of the 60° water. 90° water, even when the machine is idle, results in a pressure of 87 lbs., so the water valve should always be wide open and the

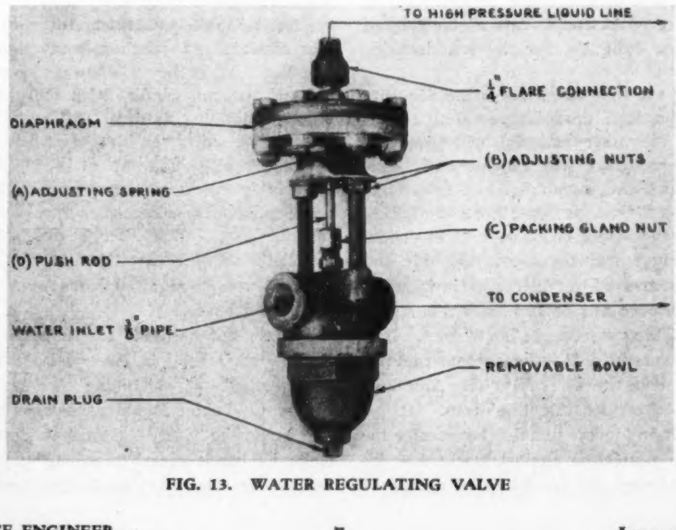

FIG. 13. WATER REGULATING VALVE

water would flow through the condenser continuously at an extravagant rate, discharging the water only a little warmer than when it entered. If this higher head pressure is satisfactory, the water valve can be set accordingly, and we find that only a normal amount flows, the drain water being 110°, however, instead of 90° plus.

Multiple Apartment Installation

Multiple apartment house installations aren't as popular today as they once were. The trend during the last few years has been to install individual refrigerators and to let each tenant pay for his own electric current. The following information will be useful, however, to anyone installing or servicing multiple systems.

A strict interpretation of the term "multiple installation" should include all of those systems where two or more cooling coils are connected to one condensing unit. The capacities of the various Copeland condensing units range from two boxes of 5 cu. ft. each to thirty boxes of 5 cu. ft. each. Because of their residential classification, apartment buildings require installation of the finest type in appearance as well as in performance. The operation of a large number of cabinets on one condensing unit makes it increasingly important that the system should be free from mechanical troubles that might cause interruption in the service. Reasonable care at the time of installation will go far toward insuring this.

One of the first essentials is the necessity of using a high grade of seamless copper tubing. No other material will give satisfactory results. The refrigeration code recommends the use of conduit to protect refrigerator lines in apartment buildings. Some of the larger cities have safety codes or municipal ordinances covering this and other features of refrigeration installation and the service man should know thoroughly the regulations existing in his district. It is also recommended that he become familiar with the code sponsored by the American Society of Refrigerating Engineers.

Conduit and metal junction boxes offer the maximum protection against mechanical injury, rendering the possibility of escape of refrigerant very remote. Briefly, the features of a first class installation are as follows:

1. Rigid and flexible conduit protecting all refrigerant lines.
2. Metal junction boxes for all line valves.
3. Outlet boxes for each cabinet.
4. Shut-off valves for each riser and cabinet.
5. Cabinets fastened rigidly to building.
6. Conduit sealed at ends.
7. Condensing units protecting against damage.
8. Approved wiring.

Always run the conduit while the building is under construction, if possible, but do not run the tubing or deliver any equipment of value to the premises until all construction work is finished, for the tubing might be ruined by workmen and other equipment might be lost or stolen. The conduit should be entirely in place before the lathing and plastering is begun. Be sure to plug the upper ends of vertical runs to prevent loose plaster and debris from clogging them. A simple wooden plug would be satisfactory.

Building Plans Should Be Studied

The building plans should be studied and the architect consulted to avoid misunderstandings concerning the location of the condensing unit and refrigerator cabinets. The conduit and junction boxes should be installed so that they will always be accessible and will not conflict with the plumbing or other building fixtures. All of these details are shown in the blue print. If necessary to cut away any part of the building to provide space, arrangement can usually be made to have these spaces or openings made without cost. Brick work and concrete especially should be watched, as a duct or recess is usually required in masonry for the risers and boxes.

The conduit used for refrigeration is the same as that used in electrical wiring but the method of installing is somewhat different. Tubing is not as flexible as wire and cannot be "fished" as easily. Therefore, make no bends except those of very large radius for otherwise the tubing could not

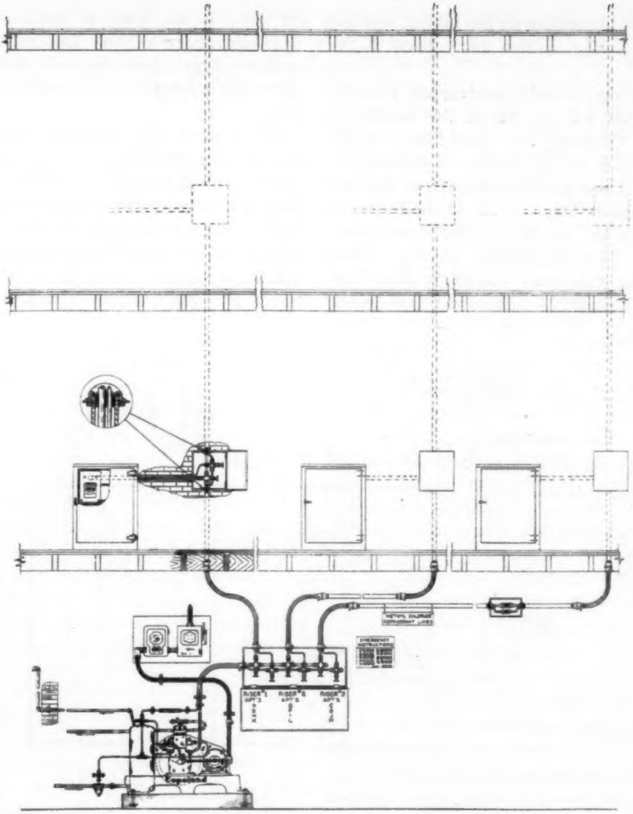

FIG. 14. MULTIPLE APARTMENT INSTALLATION

be pulled through when the installation is to be made. Metal junction boxes with hinged lids should be used wherever a sharp change in direction is made, using elbows or line valves for the tubing. The conduit is attached to these boxes with lock nuts and bushings. Standard elbows of conduit used for wiring purposes are unsuited for refrigeration work.

Conduit of 1 in. is used for one pair of suction and liquid lines; $1\frac{1}{4}$ in. for two pairs, and 2 in. for three pairs. Junction boxes have a series of incomplete holes around the lower edge which are removed as required by striking them a sharp blow. This provides a circular opening for inserting the conduit. In case the holes are not of the proper size, they may be enlarged by reaming or reduced with washers. Flexible conduit may be substituted for rigid conduit where complicated bends are to be made or at any other point considered expedient. Connection can be made from flexible to rigid conduit with box connectors which are obtainable at any electrical supply house.

Conduit ends cut and threaded by the manufacturer are reamed out to remove sharp burrs, and this should also be done to new ends. A taper reamer with a square shank is useful for this, for it can be held in a brace. Failure to remove the burrs

may result in damage to the tubing, causing a leak that may require many hours to locate.

In buildings already constructed, the conduit may have to be run on the surface of the wall, although this should be avoided wherever it is at all feasible to conceal the line. The boxes may be mounted at the side of the cabinet about 6 in. or so from the floor, with the tubing carried from there into the cabinet with flexible conduit. When the conduit and boxes are all in place, the line valves should be attached to the boxes.

In order to use boxes as small as possible, it is customary to place line valve pads of different types under them so that the flare nuts and tubing do not conflict with each other.

These pads also raise the level of the suction line from the floor of the box to just the proper height to enable connection with the ½ in. lines without bending them. The flare connections on the line valves are then in alignment with the conduit. Both the valves, of course, cannot be so placed, and the ¼ in. valve and lines should be mounted

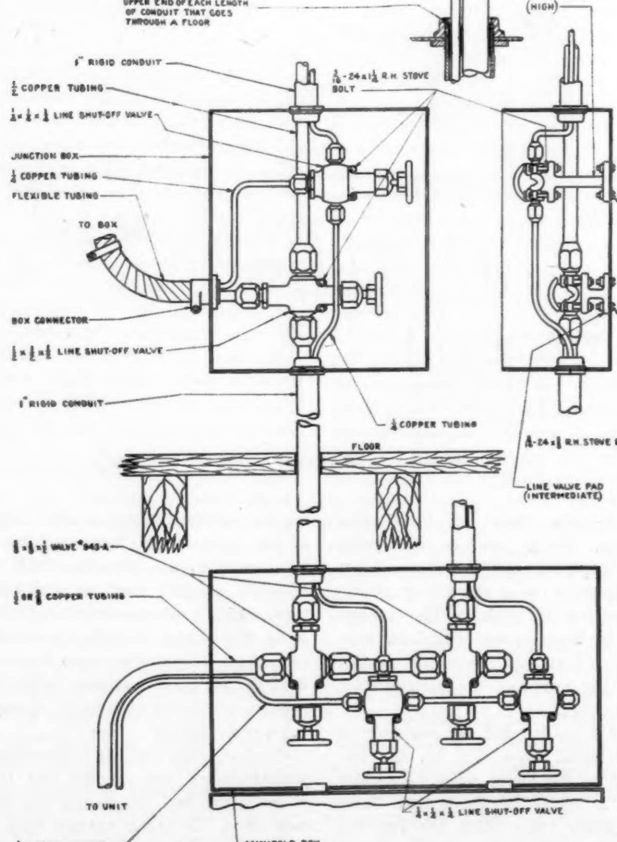

FIG. 15. MULTIPLE INSTALLATION VALVE DIAGRAM

on one side and on a higher level than the ½ in. valve. Bending the ¼ in. tubing is not difficult. The position of both valves should be such that the stems can easily be turned.

The pads are first attached to the line valves with $\frac{3}{16}$ in. stove bolts.. Then hold them in place in the junction box, marking the hole with a pencil or scriber to serve as a guide for drilling. One-quarter inch holes are the size generally used to mount the pads with $\frac{3}{16}$ in. bolts. The tubing is not "fished" until all valves are in place. It is fitted into the conduit at the upper end of each run, both lines being introduced at the same time. Be careful to avoid crossing the tubing as it is inserted, as it may bind. Only tubing in perfect condition should be used and all kinks and bends must be straightened out.

Tubing Through Conduit

In electrical work, wires are pulled through conduit with a steel tape but in refrigeration work the tubing is too rigid to follow the tape around bends. Tubing is never pushed through a bend made with flexible conduit. The section of conduit is slipped over the tubing while it is straight and then the bend is formed to the proper shape. Connectors are placed on the ends of the conduit previously. Connections are then made to the line valves, observing the suggestions concerning flaring operations. The risers are connected to manifold line valves in some certain definite order so that persons unfamiliar with the installation can easily identify and determine the purpose of each valve in case of service operations or emergency. The riser valve on the top floor will require sealing caps or blind flares to serve as "dead ends."

The condensing unit must be located in a clean, dry, cool place in the machinery room as near as possible to the various risers, the source of water supply, and in a location easily accessible for inspection, servicing or repairs. One-quarter inch tubing is used throughout the system for liquid lines, ½ in. for all suction line risers, and either ⅝ in. or ½ in. for the manifold, depending on the size of the condensing unit. The ⅝ in. line connecting the compressor with the risers can either be attached to the manifold with a tee or to the side of one of the ⅝ in. by ½ in. line valves that would otherwise be sealed with a blind flare.

When the manifold is of considerable length, connecting to risers at several points in the basement, the condensing unit should be placed near its center to equalize the suction pressure, and in that case a tee connection is required. But where the risers are grouped closely, the unit can evacuate from the end of the manifold. It is recommended that a by-pass valve be added to the manifold to connect the liquid and suction lines. This is convenient for servicing and facilitates the process of testing for leaks.

It is important that each length of conduit be sealed with brine putty or hydrolene at the upper end where it enters the junction box. Pack it well for an inch or two around the tubing to form a good seal. The purpose of this is to prevent the possible distribution of refrigerant to all parts of the system in case of a leak. It can be seen that any riser leak will be confined and will escape from only the junction box if one end of the conduit is tight enough to withstand a slight vapor pressure. See Fig. 15.

The cooling tanks are installed in the cabinet in much the same way as household types, except that multiple expansion valves with 12 in. capillary tubes must be used on each. Before hanging the coils, fill them with a 40 per cent solution of denatured alcohol and water to within ¼ in. of the top, using care to avoid spilling any solution into the expansion valve opening. The filler cap should be drawn down with a good gasket to make an absolutely vapor-tight connection. The frost bulb control is fastened to the suction line about 3 in. from the elbow, using a clamp made of copper which has excellent heat conductivity. Do not substitute tape, wire or other makeshift arrangements for best results. See Fig. 16.

The various steps of testing for leaks and placing the condensing unit in operation are but little different from those of a market installation. It may be necessary to add additional refrigerant to the system, however, if the installation is a large one. Model 7-A-1 tanks with their tubing will hold about

¼ lb. of methyl chloride during normal operation, and from this the required refrigerant charge can be calcculated. After adding refrigerant to a system beyond its normal charge, the liquid receiver is not capable of holding the entire amount and an extra drum will be needed if it is ever desired to evacuate the entire system. In operation, however, the excess refrigerant is contained in the lines and evaporators.

The presence of moisture in the system should be guarded against, both in the installation and servicing. There are always some traces of moisture in a new system and it must be removed during the first few hours of operation. Large installations should have two dryers connected in parallel to insure complete dehydration. If there are traces of water in the system, do not admit the refrigerant but circulate dry air through the job for several hours to absorb it. This is done by attaching the ¼ in. liquid line to the compressor head instead of to the liquid receiver. Two dryers are inserted to extract the water from the air as it circulates. Be certain that they contain only fresh, chemically pure calcium chloride.

After the installation has been completed, the system has been tested for leaks, evacuated, dried out, the required amount of refrigerant has been added, and the system is ready for operation, set the pressure control to provide the required cooling tank temperature. The cooling tank temperature is the temperature of the non-freezing solution in the tank. The pressure control should

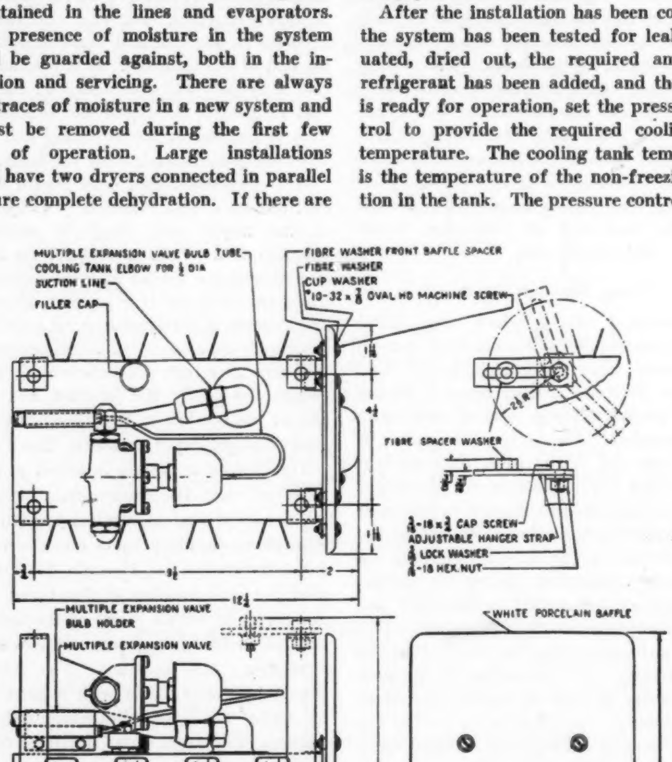

FIG. 16. COOLING TANK WITH MULTIPLE VALVE ASSEMBLED

be set at a cut-in point of 28 lbs. and a cut-out point of 5 lbs., merely in the nature of a trial. An inspection should be made the following day to make any changes in adjustment that are considered advisable.

The multiple expansion valves are so adjusted that the suction line will frost as far as the control bulb but no farther. Turning the cap to the left will retard the frost by lowering the pressure; turning to the right extends the frost formation. *Do not entirely remove the cap from threaded portion of the valve body or the bellows will become distorted and unfit for use.*

Temperatures in the various cabinets can be changed slightly to suit the wishes of the individual tenant by adjusting the expansion valve, although this is to be avoided if possible. The proper way to establish temperatures is to adjust the pressure control but, of course, this affects the entire system uniformly. Do not under any circumstances advise a tenant regarding the adjustment of a multiple expansion valve. They are not competent to make such adjustments. Changes in the expansion valve adjustment can only be made gradually. Never turn the cap more than one-half turn at a time. It is better to visit one apartment after another, making slight changes in each valve setting without attempting the final regulation of any, than it is to stay with one valve until the frost back is satisfactory.

Ice Cream Cabinets

Ice cream cabinets are built in three general types, known as portable, standard and combination. The portable type is made with two, three or four holes and is of somewhat lighter construction than the standard models. The two-hole model is usually equipped with a 1/6 hp. condensing unit. The three and four-hole models use a 1/4 hp. unit, and a 1/3 hp. unit is used up to 12 holes. Combination cabinets provide refrigerated storage space for bottled goods, etc. These cabinets are rarely built larger than with six holes for ice cream and they are equipped as a rule with 1/3 hp. units. Ordinarily, ice cream cabinets are shipped with the condensing unit mounted in the cabinet, but they can also be purchased for remote installations, in which case the unit compartment is furnished in a separate housing to be mounted in some convenient location apart from the cabinet.

The service man will often be asked by the storekeeper to add his ice cream cabinet to the same condensing units operating a refrigerator or some other 40° application. The Copeland snap-action valve will give good results when used to provide the temperature differential required. However, the use of an entirely separate condensing unit for the ice cream cabinet is recommended to obtain the highest type of performance.

Connecting Ice Cream Job

Connecting up an ice cream job is as simple as the methods used in household refrigeration. The use of a "regular" expansion valve and a temperature control is advocated. Multiple expansion valves are difficult to regulate on ice cream cabinets and are prone to cause frosting-back on the start-up.

If the cabinet is not equipped with a dry expansion coil but has a flooded coil with a float type valve, ascertain whether it is designed for use with methyl chloride. If not, it would not be advisable to use it without first having the float recalibrated or, better still, completely replaced. It may be possible to replace the original with a standard expansion coil. In case the cabinet has been in service before with a different refrigerant, it is imperative that all traces of both oil and refrigerant be removed.

For the dry system, set the expansion valve at even pressure and the control at 10 to 5° above zero. The flooded system is adjusted exactly the same unless it is used with a pressure control, in which case it is arranged to cut in at 5 points and to cut out at zero. It is quite possible to use either a temperature or a pressure control with a flooded coil. The adjustments suggested here are only approximate. Circumstances differ for each installation as well as the demand of the user. Brine should be made up of a 40 per cent solution of denatured alcohol and the tank filled to the proper level.

This article will be continued in the February issue with additional information on the multiple expansion valve and controls and presenting some miscellaneous servicing suggestions.

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THE

Question BOX

Readers are invited to send their problems pertaining to the servicing of household refrigerators and small commercial refrigerating equipment as well as oil burners to "The Question Box" which will be answered by competent authorities.

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THE following questions submitted to this department are answered by Mr. George H. Clark, chairman National Educational and Examining Board, Refrigeration Service Engineers Society.

Have any readers other opinions regarding the problems involved. Send them to the Editor.

Direct Expansion Brine Machines

QUESTION 102. *I have encountered some trouble with three brine machines which I have been unable to overcome. We have nine direct expansion custard machines and they work perfectly. We have transformed some of our salt and ice machines to refrigerated brine type machines by installing 100 ft. of galvanized pipe wound in a circle large enough to leave the tank (custard) rotate on the inside. We have a 1½ in. tube around this which holds 25 gallons of brine (calcium chloride). We use a Detroit expansion valve, model 673 (thermostatic). We have from the compressor a ¼ in. liquid line with 2-⅝ return lines. The compressor is a Universal Cooler serial No. 11071 (do not know the model; please state if possible). It is a three-cylinder water cooled driven by a 5-hp. Wagner motor. The compressor runs with a head pressure of 120 lbs. We have tried on the low pressure side a pressure of 15 lbs. to a vacuum of 15 in. but it doesn't help.*

What is the reason it takes this machine an hour to get the temperature down to 4°F. from 50°F.? And when the brine is not in circulation it will fall a little faster, but not much. I think it should be the opposite. Any suggestions you would have as to how we can make this machine work faster and get it colder in less time will be appreciated. It should run at 0°F. to make custard properly and be able to hold it there as this is a continuous freezer under 40 lbs. pressure from the start to the finish of running custard. This cooler works perfectly on the direct expansion machines.

ANSWER: Not being any too familiar with your custard machine, I do not know why the temperature does not drop from 50° to 4°F. in a shorter time, but there are two things apparently not right. I believe you will find that your ¼ in. liquid line for this size job is a little small. Possibly a ⅜ in. liquid line would be better. In addition, the 673 thermostatic expansion valve is not large enough to take care of the amount of refrigeration furnished by a 5 hp. machine. If two coils could be used and two of the valves used, they would probably give much better results. Furthermore, the pressure control setting should be adjusted to operate from 4 lbs. on to 18 or 20 in. vacuum off, provided this is a methyl chloride system.

I cannot gather from your description whether you have a separate brine cooler in which your brine is cooled and then the cold brine circulated around your custard machine. If this is the case, it is quite possible that you have considerably more than 25 gallons of brine in the complete system and this would account for the slow drop in temperature.

Purging SO_2 Condensing Units

QUESTION 103. *I have had occasion where it was necessary to purge SO_2 condensing units. You usually have to be accessible to the window for an extension for tubing to the outer air. If a sink is nearby, you can run the tubing down a drain pipe, or use lye and water, or discharge into a drum. On this particular job, I am handicapped quite a bit outside of the use of a drum or lye water. Is there any other method that this air can be purged out of the system?*

ANSWER: In purging SO_2 I have found that it is not advisable to purge the gas out a window as it may damage plants and

shrubs in the vicinity and get the service man in difficulty with the customer.

It may be purged down a drain with water or it may be purged into a tank of lye and water. However, I have found that as satisfactory a way as any is to purge the SO_2 directly into a pail of water and when the water is so saturated with SO_2 that the odor becomes quite strong, the water may be poured down the drain and a fresh pail used and the process continued until enough purging is done. I have used pure water with a greater degree of success than lye and water. One should be extremely careful, of course, not to allow any of the moisture to work back into the system and one should also use precaution against directing the stream of SO_2 directly against the side of a galvanized pail as it will burn a hole through the side of the pail in the presence of water. Some other vessel than a galvanized iron pail may be advisable as the water saturated with SO_2 will cause the galvanizing to turn dark and it may not be thoroughly cleaned out afterward.

Chemical Action from Cadmium Plate

QUESTION 104. *If an evaporator on a domestic refrigerator is cadmium plated, is there any chemical action that is poisonous to food, etc.?*

ANSWER: I have been informed that any food which has an acid reaction and which comes into direct contact with either cadmium or chromium will cause some poison to be formed. For that reason cadmium and chromium are not used in ice cube or dessert trays where sherbets might be made and I doubt if it would be advisable to cadmium plate the evaporator itself.

I believe that this is probably the reason for electro-tin plating the greater majority of the evaporators which are not porcelain finished.

Domestic Refrigerator Trouble

QUESTION 105. *I am having trouble with a domestic, which I have been called upon to service. Its operation might be described as follows: When I was called in on the job, it had two short "on" cycles of about 1½ or 2 minutes, followed by a longer "on" cycle of about ten minutes, frosting-back to the compressor during the short "on" cycles only. The "off" cycles were fairly constant, about ten or twelve minutes.*

I replaced a new expansion valve (American Injector) with another new valve of the same type. The cycle now is as follows: "On" 12 minutes, "off" about 28; "on" two minutes with a frost-back, "off" ten minutes; and repeating this cycle of operation. I can't understand how two new valves would go bad, so I eliminated this from my conclusions.

The back pressure shows 8-9"; head pressure was 65 in a 75° room. Receiver warm on "long" cycle. Liquid line room temperature. Have a new Ranco "KRS" type control with bulb attached snugly to fourth outside coil from front of evaporator. Evaporator is of the dry type and frosts okay. The last time I tested compressor it tested okay and no leaks in system, which is an SO_2 *job.*

ANSWER: The trouble which you report on the refrigerating system using the dry type evaporator is one that occurs quite commonly with these evaporators having very little holdover. This may be due in a good many cases to having too little differential. In other cases, it may be caused by a faulty expansion valve allowing the refrigerant to enter the evaporator during the "off" cycle.

In your particular case, since the cycles are not unduly short, it would seem that the trouble might be caused largely by a small leak by the expansion valve. Since you have replaced the valve with a new one and get a continuation of the same trouble, this would tend to eliminate this possibility. However, it may be that due to some moisture in the system or some dirt in the system the new valve may not be operating perfectly.

There are two remedies for this short cycling condition. One is to clamp the control bulb to the sleeve of the evaporator about one inch from the evaporator tubes instead of clamping it directly to the refrigerant tube.

Another remedy is to clamp the control bulb to the suction line just as it leaves the evaporator by means of a clamp which separates the control bulb from the evaporator

tube and which does not cause the control bulb to feel the low temperature from the suction line as quickly as it would if it were clamped directly to suction line. In this latter case it may also be necessary to increase the differential setting of the control in order to prevent short cycling.

In either case this may not prevent the frost back which occurs after the machine first starts operating, but this frost back will be only temporary and should not cause any particular trouble. Of course, leaking head valves in the compressor would also cause a frost back, but would tend to cause much shorter cycles than those which you mentioned.

Volume Column of Liquid and Vapor

QUESTION 106. *In lecture 3 of the R.S.E.S. Educational Course, the volume column of the liquid and vapor has "ft. 3 lb." I don't quite understand what the 3 is for. Isn't the volume the volume of one lb. of refrigerant at the given temperature?*

Do you have a table giving the amount of saturated gas to be pumped to produce a ton of refrigeration at a given temperature? If you don't, please advise where I can get one. It would be very beneficial in determining the compressor displacement for a given refrigeration load. In fact, you would have to know the amount of gas to be pumped before you would know at what speed the compressor must run and before you would know what bore and stroke should be used, wouldn't you?

ANSWER: In Lecture 3 in referring to the column concerned with the volume of liquid and vapor refrigerant, the heading "ft. 3 lb." is intended to specify the volume of the refrigerant in cubic feet per lb., the 3 intending to specify the third power of feet.

You are right in assuming that the volume stated is the volume of one lb. of the refrigerant at the given temperature, the volume of the liquid being independent of the pressure; but the volume of the vapor refers to the volume of one lb. of saturated refrigerant vapor. That is, if the refrigerant vapor were at a temperature higher than the boiling point, it would be superheated and its volume might be estimated from the properties of the superheated refrigerant. The V column under "Super-Heated Refrigerants" is the volume of the refrigerant in cubic feet per lb. of the super-heated vapor.

As far as I know, there is no table giving the amount of superheated gas to be pumped to produce a ton of refrigeration at a given temperature and, frankly, I do not know where one may be obtained as the quantity of refrigerant to be pumped to produce a ton of refrigeration depends upon the temperature at which we are going to refrigerate and also upon the temperature of the liquid entering the expansion valve. It might be possible to work out such a table, but it would be somewhat bulky as it would be necessary to specify the number of lbs. of refrigerant to be circulated to produce a ton of refrigeration at various refrigeration temperatures and with various incoming liquid temperatures at each of the refrigeration temperatures.

In order to determine the number of lbs. of saturated vapor that must be moved for a given amount of refrigeration, we can determine the number of lbs. of refrigerant to be circulated by dividing the refrigeration load in B.t.u.'s per hour by the difference between the heat content of the saturated vapor and the heat content of the liquid to the expansion valve. The volume of the saturated refrigerant would be the number of lbs. of refrigerant per hour times the volume of the saturated vapor in cubic feet per hour. The compressor displacement for this particular load would be this number of cubic feet per hour divided by the volumetric efficiency of the compressor. Under normal conditions the volumetric efficiency can be assumed as being from 60 to 80%.

(Questions and Answers Continued on Page 23)

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ALCO OPENS CHICAGO OFFICE

A DISTRICT sales and engineering office has been established at 543A W. Washington Street, Chicago, by the Alco Valve Co. of St. Louis. A warehouse stock of Alco valves will be carried.

Mr. J. A. Schenk who has had both technical and practical training and who for the past year has been conducting application research at the factory will be in charge.

Dehydrators

There Is Yet Much to Be Learned About Dehydration, But This Article Contains Some Fundamental Information With Which Every Service Engineer Should Be Familiar.

By GEORGE H. CLARK,* B.S.M.E.

THE subject of dehydrators, driers, or corrosion arrestors, as they may be variously described, is one on which there has been practically no real information available. There still is no real, authoritative information available so the information contained in this article must not be considered as final. However, a considerable amount of investigation and personal experience with the various types of dehydrators now in use leads to some conclusions as to the practicability of the various drying agents for refrigeration work.

Reasons for Using Dehydrators

First of all, let us review the reasons for using dehydrators. These reasons are chiefly; first, to remove moisture from the refrigerant and thereby eliminate the cause of mechanical freeze-ups; and, second, to minimize corrosion which results from the introduction of water in the refrigeration system. Naturally no one puts water into the refrigerating system intentionally. Nevertheless, it does get in. It may enter the system as a result of leaks in the low pressure part of a refrigerating system where such low pressure part is operated at pressures lower than atmospheric pressures. It may enter the refrigerating system as the result of a leak in a water coil in a water-cooled condenser, or as the result of a leak in the expansion coil of a brine tank or some other type of evaporator. It may also get into a system with oil or refrigerant which is not entirely moisture free. When installing a refrigerating system, moisture may be present in the copper tubing used unless precautions are taken to insure that the tubing is not left open and, of course, all lines should be completely evacuated of all air with its attendant moisture before the refrigerant is circulated through the system.

"Mechanical freeze-up" is the term applied to the freezing up of the moisture in the refrigerant at the point where the pressure and consequently the temperature of the refrigerant is reduced. Mechanical freeze-ups are considerably more common in the dry type of refrigerating systems than in the flooded type. The reason for this is apparent. In the flooded system as the refrigerant cools the moisture freezes into ice crystals which float in the refrigerant but which do not return to the compressor and recirculate through the system. In the dry type of system the moisture freezes in the evaporator, but since the evaporator consists of a continuous passageway, the ice crystals are washed through into the suction line where the ice melts and the water passes into the compressor and through into the condenser and receiver and liquid line back to the expansion valve where the moisture may freeze solid at the valve orifice and thereby prevent the proper flow of refrigerant through the valve. Generally the effect of the mechanical freeze-up is to freeze the valve orifice closed so as to cause a high vacuum on the low pressure side of the compressor. However, the valve needle occasionally freezes in the open position so as to let refrigerant through too fast and thereby causes an increase in suction pressure and consequently little or poor refrigeration.

Mechanical freeze-ups occur with practically all low pressure refrigerants except sulphur dioxide. Sulphur dioxide combines so readily with moisture itself that the moisture does not circulate through the system

* Detroit School of Refrigeration. Chairman, National Educational and Examining Board, R.S.E.S.

as water but combines with the sulphur dioxide to form sulphurous acid which does not freeze out at the expansion valve.

Prevention of Mechanical Freeze-ups

Experience has shown that mechanical freeze-ups can be prevented in two ways. First, we can put some agent into the refrigerating system which will combine with the moisture in the system and will thus make a non-freezing solution which may circulate through the system without any appreciable harm as far as mechanical freeze-ups are concerned. This solution to the troubles concerned with moisture in Isobutane or any hydro-carbon refrigerant has worked out fairly well in the past. A small amount of grain alcohol put in the Isobutane refrigerating system tends to combine with the water to form a non-freezing solution and it has no effect on the Isobutane itself, so that this will prevent mechanical freeze-ups where a very slight amount of moisture is present. However, where the amount of moisture is very great, it has often been found advisable or necessary to use a drier rather than alcohol in the system. Experiments have been tried using methylene chloride to prevent mechanical freeze-ups in methyl chloride refrigerating systems in the same manner. So far, indications are that the methylene chloride reacted with other parts in the refrigerating system and did more damage than good. In the small direct-driven Copeland refrigerating system, this methylene chloride apparently reacted with some of the Bakelite motor parts in the motor and the compressor assembly, which apparently formed carbolic acid in the system which attacked expansion valve needles and seats causing leaks by the expansion valve needle, attacked the valves, and may have had a detrimental effect on motor windings as well.

Grain alcohol in connection with methyl chloride does not have the same effect that it does with isobutane since the alcohol apparently combines with the methyl chloride rather than with the moisture in the system and as a result it does not prevent mechanical freeze-ups. I believe it is reasonable to assume that alcohol which is quite dry may be used with some degree of success in preventing mechanical freeze-ups in isobutane and butane or, in other words, with the hydro-carbons used as refrigerants.

To absorb the moisture from the refrigerant and thereby prevent mechanical freeze-ups, the drying agents which have been used consist of calcium chloride, calcium oxide, activated alumina and silica-gel. In connection with their drying properties, I might mention each of them separately.

Calcium Chloride

Calcium chloride has been used extensively in the past, and at the present time it is undoubtedly the fastest drying agent in common use as far as removing moisture from the refrigerant is concerned. That is, a system which contains a small amount of moisture and which is troublesome due to mechanical freeze-ups may have a calcium chloride drier installed in the liquid line before the expansion valve, which will practically eliminate any further trouble due to moisture freezing at the valve. In general, it has been found that when mechanical freeze-ups do occur, a calcium chloride drier may be installed in the system for a period of from one day to a week, after which it may be removed from the system. If the drier is left in the system continuously, it seems that some calcium chloride circulates with the refrigerant as a salt solution and as it is in itself a very corrosive material, it is quite probable that by leaving a calcium chloride drier in the system continuously the corrosion resulting from its use may be a very serious service problem. The calcium chloride drier may be used in either liquid or suction lines, but is generally used in the liquid line where a small restriction to the flow of liquid is not serious; that is, the flow of liquid is so slow that little drop in pressure will be caused by the drier in the system. With the drier in the suction line, the drop in pressure by the drier may be more serious; first, in that the drop in pressure will be greater due to the fact that there is a higher gas velocity; and also due to the fact that a small drop in pressure in the suction line has considerably more effect on the system. Where the drier does plug in the liquid line, it is quite usual to find the line frosted or sweating where it leaves the

drier. Wherever any appreciable difference in temperature may be noticed between the lines entering and leaving the drier, it is safe to say that there is an appreciable restriction in the drier and it should be changed.

Carbon Oxide

Calcium oxide has been used considerably of late in connection with methyl chloride and "Freon" refrigerating systems and works out very well except that its drying action is not nearly as rapid as is the action of calcium chloride. If the quantity of moisture in the system is not great enough to cause continuous trouble of the mechanical freeze-up nature, the calcium oxide drier will gradually remove the moisture and at the same time will not cause corrosion in the system on its own account. The calcium oxide in uniting with moisture forms calcium hydroxide or slaked lime which is a fine powder and which may circulate to some extent in the system. Occasionally this fine powder will plug screens or it may pass through the screens and plug the orifice of expansion valves although the claim has been made that a small amount of the calcium hydroxide powder circulating through the system has no harmful effects. In any case the drier should be provided with filters to prevent all but the very finest of powder from circulating through the system.

Activated Alumina

Activated alumina is used with both sulphur dioxide and the other refrigerants. It apparently acts as a fine metal sponge, absorbing the moisture while letting the refrigerant pass on through. However, this activated alumina is very slow as a drier and where mechanical freeze-ups occur it will not prevent them when first installed. If, however, the activated alumina drier is left in the system long enough and the refrigerant can be made to circulate through it for a considerable period of time, it will absorb the moisture and prevent further freeze-ups. It has a tendency to become clogged with oil so that its spongelike powers of absorbing moisture are somewhat nullified and slowed down since the oil is generally circulating with the refrigerant.

Silica oxide, or silica-gel as it is commonly called, is a very good absorber for moisture, but it is also an absorber for the refrigerant itself, and in addition to this, it may become covered with oil so that its absorbing qualities are not as effective as they might otherwise be. As a result, the drier using silica-gel has not been used very commonly or with any degree of success in a system.

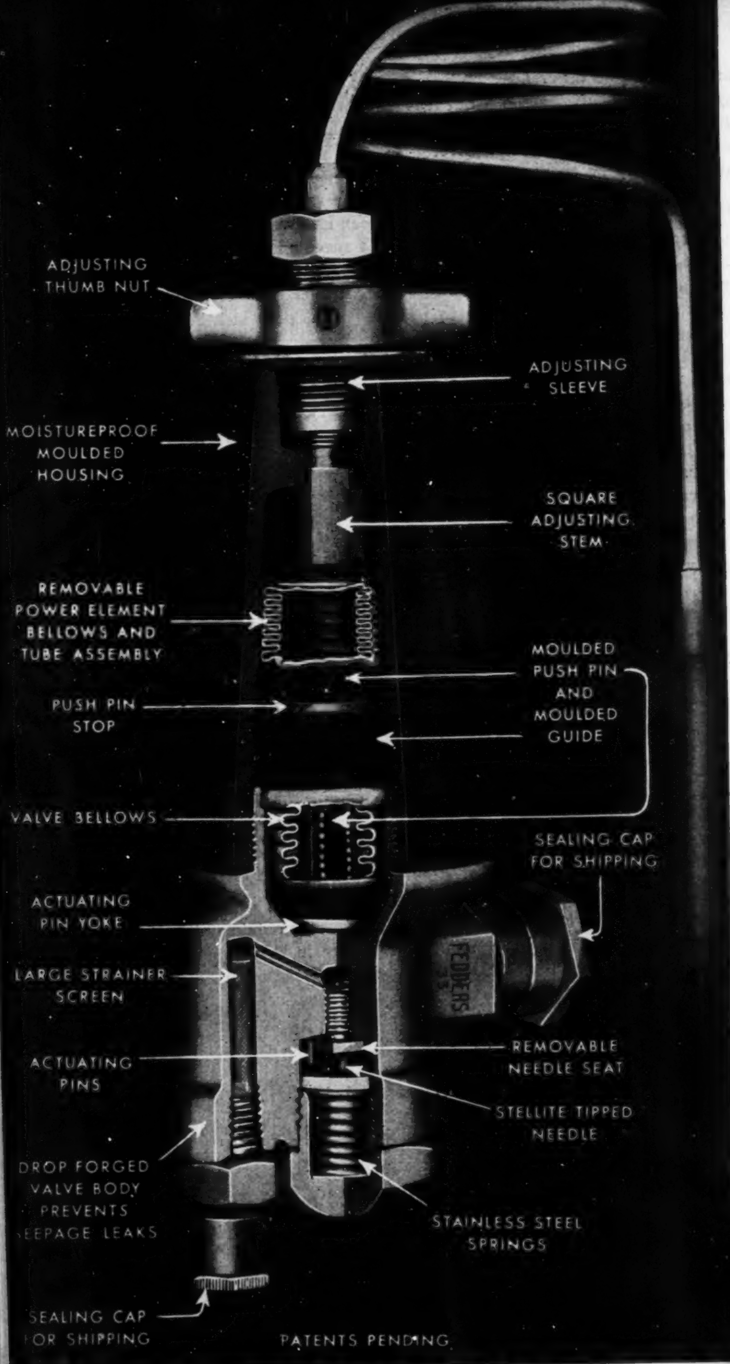
The second reason for using a drier or, in this case more properly a corrosion arrestor, is to prevent corrosion which results from an acid being formed in the system as the result of moisture entering the system and combining in some manner with the refrigerant. This is especially apt to happen with sulphur dioxide which combines very readily with the moisture to form sulphurous acid. Chemically we would show the reaction as follows:

$$SO_2 + H_2O = H_2SO_3$$

We may have the effect of sulphuric acid which would be the result of combining some free oxygen with the sulphurous acid to get a sulphuric acid reaction. The free oxygen would undoubtedly be drawn into the system at the same time the moisture entered the system; that is, the moisture which enters the refrigerating system is generally the result of drawing air with its small moisture content into the system through a low pressure leak or in not thoroughly evacuating the system of all air and moisture when the system was first put into operation.

Sulphur Dioxide and Corrosion

Sulphur dioxide then is especially apt to cause corrosion when combining with a small amount of moisture in the system. Methyl chloride and some of the other refrigerants also tend to show some acid reaction with a small percentage of moisture and air in the system. Just what this reaction is, is not thoroughly understood. However, it is known that methyl chloride in combining with a small amount of moisture does have a dilute hydrochloric acid effect in a refrigerating system and it is probable that the other refrigerants, such as "Freon" and ethyl chloride, behave similarly, so that in the case of these refrigerants we need the corrosion arresting effect as well as the protection against the mechanical freeze-up as previously described.



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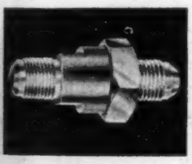

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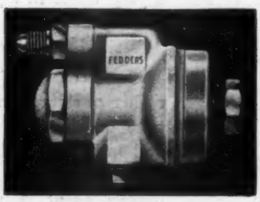

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It may be well at this time to state that corrosion is the result of an acid or a salt setting up a low voltage electrical cell when in contact with two unlike metals.

All metals can be listed with respect to chemical activity. Carbon rates very low as to chemical activity while aluminum, zinc and some other metals rate comparatively high. In the case of a dry cell we have two metals; namely, zinc and carbon, which are connected by a salt solution and when a wire is passed from the carbon electrode to the zinc, a current passes from the carbon to the zinc and a chemical reaction takes place in the cell itself, which tends to use up the most active metal; namely, the zinc. If any two electrodes are placed in the salt or acid solution, a mili-voltmeter connected across the electrodes would register a small voltage. The voltage set up would be dependent upon the rate of chemical activity, and the metal having the lowest chemical activity would be positive and the metal having the highest chemical activity would be negative as far as the voltage was concerned.

Effect on Metals

In our refrigerating system we have several different metals. Usually we have copper, iron, steel (which is a combination of iron and carbon) and brass (which is an alloy of copper and zinc), so that we have several different metals in the system, and if the refrigerant circulating through the system has either an acid or salt reaction it will cause small electric currents to be set up, which uses up the metal at various points in the refrigerating system. This effect is most noticeable at the needle and seat of the expansion valves, float valves, etc. and may also be noticed at the suction and discharge valves, or in other words, at the point in the system where the velocity of the refrigerant is greatest.

The method used in eliminating this corrosive effect is to install a dehydrator in which an active metal or a compound of some active metal is used as a dehydrating agent, or rather which reacts with the acid or salt in the system to use up any acid which may be formed.

For this purpose zinc has been used in several forms, especially in connection with sulphur dioxide. Some success has been met with by using a feathered zinc in a drier shell and installing this in the liquid line. The theory is that the zinc reacts with any sulphuric acid to form zinc sulphate which remains in the drier, and free hydrogen, which is a non-condensable gas, will be liberated from the acid and will simply go to raise the head pressure in the system due to adding the hydrogen to the receiver.

Oxides of aluminum and calcium apparently have also been used with some degree of success in preventing corrosion in systems which otherwise would show some acid reaction. How this action could be explained chemically, I would hesitate to say. It is possible that calcium oxide would combine with sulphuric acid to form calcium sulphate and water and that the water would combine with some of the rest of the calcium oxide to form calcium hydroxide or, in other words, slaked lime. Calcium chloride in itself is a salt and as such has practically no value as a corrosion arrestor.

However, a calcium chloride drier may be used with some success in a sulphur dioxide system provided it is located in the suction line of the system rather than in the liquid line. The vapor in passing through the calcium chloride may actually give up moisture to the calcium chloride as a moisture absorber while the sulphur dioxide passes on into the compressor. The calcium chloride drier when installed in the liquid line of a sulphur dioxide system has little, if any, drying effect in my estimation.

Construction of Driers

The mechanical construction of driers is rather obvious. In general, it consists of a tube or container of some sort with inlet and outlet connections suitable for the liquid or suction tube it is to be used with. The drying agent is usually confined between screens at each end and the screens at each end may be compounded of two or more layers of a bronze wire mesh screen and may include some asbestos cloth or felt between layers of wire mesh.

In summarizing, we might say that for sulphur dioxide a drier is not really effective except when placed in the suction line, and

probably no drying agent outside of calcium chloride is especially effective in the suction line. For use in the liquid line as a corrosion arrestor, zinc or activated alumina may be used with some success.

For the other refrigerants including ethyl chloride, isobutane, methyl chloride and "Freon," calcium oxide and activated alumina may be used where the quantity of moisture is small and it is not necessary to remove the moisture in a very short period of time. Where fast drying is required, there is nothing apparently which takes the place of calcium chloride, but where calcium chloride is used, the drier should not be left in the system continuously or for a period of more than a few days, and if the system contains a large amount of moisture it may dissolve the calcium chloride and circulate the calcium chloride solution through the system which will require a complete cleaning out of the compressor, receiver and all refrigerant-containing parts of the system. In connection with hydro-carbon refrigerants, it is possible that mechanical freeze-ups may be prevented by introducing some dry alcohol in the system. However, this is a poor substitute for actually drying the system by some other means.

Although we quite often find it necessary in service to use driers, it is by no means to be assumed that any drier so far used is a substitute for having the complete system perfectly dry to start with, and where very much moisture is contained in the refrigerating system, it may be necessary to completely empty the system of all oil and refrigerant, to bake out the individual parts in the system, reinstall and start the system up free from all moisture. Where driers are used, it is quite probable that less trouble will develop if the drier is installed for a period of several days or a week and is then removed from the system entirely, rather than leave the drier in the system indefinitely.

QUESTIONS AND ANSWERS

(Continued from page 16)

Suction on Refrigerator Compressor

QUESTION 103. *What are the advantages and disadvantages of having suction on refrigerator compressor? In crank case? Trunk type position? Suction valves in cylinder head?*

ANSWER: The advantages or disadvantages of the various locations of the suction connections on refrigeration compressors are largely concerned with the circulation of oil in the refrigerating system.

With the suction line hooked into the compressor crank case, the vapor entering the crank case will pick up oil which is splashed up by the compressor connecting rod and the oil will circulate through the piston valve, the compressor head valve, and thus into the rest of the refrigerating system. Oil in the refrigerating system does not do any good and may do considerable harm. In the first place, the oil which leaves the compressor may remain to some extent in flooded type evaporators and thereby leave the compressor low on oil and cause the evaporator to not function properly due to an excess of oil. Thus we frequently have in low pressure float valve multiple systems the trouble of oil bound floats and in addition it is often quite necessary to add oil to the compressor. With dry type refrigerating systems the fact that the compressor pumps oil into the rest of the system is not such a disadvantage, as the oil washes through the evaporator with the vapor and returns to the compressor. However, with the suction line in the compressor crank case we have a decided tendency to pump oil with our compressor.

With the trunk type of piston where the vapor enters the cylinder between two sets of piston rings, if there is no connection between the suction line and the compressor crank case, there is no tendency to pump oil except due to faulty piston rings on the lower part of the piston. One disadvantage, possibly, to this type of system is that the upper part of the piston runs quite dry as the upper part of the cylinder wall gets little if any lubrication. The Peerless two and five hp. machines of the older style are notable examples of this type construction. The cast iron evaporators used with these machines are particularly susceptible to oil in the evaporator; that is, with a small quan-

(Continued on page 38)

Many Changes Made in New Refrigeration Ordinance for New York City

Revisions Alter Current Installation Practices—Final Draft Will Be Published When Available

THE final revised draft of the proposed code of the State of New York, relating to installation of refrigerating systems, was issued by the New York Fire Department, November 7. Many significant changes and added provisions were made in the original draft as published in the February, 1935, issue of THE REFRIGERATION SERVICE ENGINEER. These changes, it is said, would have the effect of considerably altering current installation practices.

The principle additions and changes deal with restrictions on the use of refrigerants, particularly in direct expansion systems; the use of soldered joints; regulations governing the testing of systems; rules regarding safety devices; and qualifications and fees of licensed installation and operating engineers.

The final draft also defines non-irritant refrigerants and non-flammable refrigerants in considerable detail, while the first draft described these more briefly. The amount of refrigerant that can be used in direct expansion systems for air conditioning in residences and offices is definitely limited while for department stores and public buildings the use of direct expansion cooling systems for air conditioning purposes is practically eliminated. Where refrigerants such as "Freon" and Carrene are used in a room where there is an open flame, there must be a hood for removing the products of combustion to the open air.

The installation and servicing of all refrigeration equipment can be done only by those licensed by the Board of Examiners. No refrigerating system containing more than 100 lbs. of refrigerant can be operated in any building except under the personal supervision of either a licensed engineer or a person who has obtained a certificate of qualification to operate such a system.

Soldered joints are allowed in tubing up to 2⅛ in. O.D. and flared joints in tubing up to ¾ in. O.D. The melting point for solder used in joints must be not less than 400° F. In the previous draft this had been established at 1300° F. Specific restrictions also were placed on the type of fitting which may be used.

In the regulation of safety devices, an additional provision is that a fusible plug will not be accepted in lieu of a spring loaded pressure relief valve where such valves are required. The code also calls for tests on premises where the system is to be operated, and specifically bars the use of oxygen for test purposes. A number of new provisions also have been added setting up regulations for the construction of duct work and fresh air intakes on air conditioning systems.

Public Hearings

The code in its revised form has not yet been accepted and is still subject to further revisions. A public hearing on the proposed code was held December 5 and again December 11. At the second hearing, controversy developed over the question of qualification of various types of refrigerants for use in air conditioning systems, following the publication of a sensational news story in the *New York World Telegram* which asserted that passage of the ordinance would give certain interests an effective monopoly on the air conditioning business. This subject had been raised at the first hearing and

had developed little controversy, but at the second hearing it became a matter of considerable heated discussion.

At this hearing the Virginia Smelting Co. led the fight to amend the code to make possible the use of sulphur dioxide, ammonia, and methyl chloride under less complicated restrictions, and also contended that the ordinance in its present form gave a virtual monopoly on refrigerants for air conditioning use to certain companies. E. T. Williams, consulting engineer, led in a fight to impose more stringent phraseology in the provisions of the code governing the use of the "Freon" group of refrigerants.

Present Code Defended

W. W. Rhodes, of Kinetic Chemicals, Inc., DuPont subsidiary which manufactures the "Freon" refrigerant, defended the code as it was written, and claimed that there was no monopoly created for "Freon" by virtue of any code but that the refrigerant had won its place by its own inherent qualities.

A. H. and F. A. Eustis, of the Virginia Smelting Co., contended that in the indirect open spray type of refrigerating system, an alkaline brine used where sulphur dioxide is the refrigerant, and an acid brine for ammonia systems, would serve to absorb any of the direct expansion refrigerant that should pass into the cooling chamber, cooling the irritant effect and thus eliminating the hazard.

Criticism also was directed to that part of the code which calls for the operation of mechanical refrigerators and unit air conditioners in department stores in rooms shut off by tight partitions. Robert Bryan, representing Frigidaire, led the fight on this point, and a number of written protests on the provision were read into the records.

Controversy also developed over the provisions relating to refrigerating machinery rooms and to the placement of refrigerant piping. Representatives of the commercial and industrial divisions of the refrigeration industry feel that the ordinance is too restrictive in this matter, with the result that unnecessary expense would be entailed in installations.

Another point of contention was on the melting point of solder for refrigerant piping joints. The provision dealing with this subject was changed in the final proposed draft of the code so as to provide for a melting point of not less than 400° F. instead of 1300° F. Proponents of the high temperature solder criticized this change, but the low melting point was just as vigorously defended by other interested parties.

Sulphur Dioxide Defended

At a third hearing held December 18, further protest was made against the proposed code as being too restrictive with respect to sulphur dioxide and methyl chloride. F. A. Eustis, of the Virginia Smelting Co., stated that only three deaths had occurred from sulphur dioxide in seventeen years, while in the same period there were eleven deaths attributed to carbon dioxide, which is classified as a safe refrigerant under the code.

W. H. Allison, of the Automatic Refrigerating Co., requested that the code be amended to permit the use of methyl chloride. He said his company had made a practice of limiting the methyl chloride in any system to an amount which, if released, would result in a concentration no greater than two per cent by volume. He maintained that the same provision could be written into the code.

In view of the fact that the revised code as it now stands appears to be subject to further revisions and changes, publication of the final draft in The Refrigerating Service Engineer will be deferred until it is finally accepted or until it appears to have been prepared in a more permanent form.

NEW REFRIGERATION EQUIPMENT CATALOG

A NEW refrigeration equipment catalog has recently been issued by the Refrigeration Economics Co. of Canton, Ohio—Bulletin C-1935—containing comprehensive information regarding the refrigeration equipment manufactured by this company including fin coils, bare pipe coils, and forced draft unit coolers.

The catalog illustrates a number of actual installations showing the various equipment installed as well as the type of coil applicable for various installations.

The REFRIGERATION SERVICE ENGINEER

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REFRIGERATION SERVICE ENGINEERS' SOCIETY

SELLING YOUR SERVICE

By James H. Downs

WHY are some service engineers of slight or no ability hailed by their customers as "miracle men"? Why are some really expert men condemned as bunglers? Why do some men get orders that you couldn't get even at a lower price? These and many others are the questions we have often tried to answer. Because arriving at the proper answer is the difference between failure and success in the service business.

Too often by our earlier training we are led into selling methods which are wrong and which are costing us much business. But quite often a little close study will enable us to correct these faults to our own great advantage. We must emphasize at the start that we do not claim to have a "one perfect method." There is no such thing and never will be as long as human nature is the varied thing it is. Each customer presents new problems and no one method is adapted to all customers or to all salesmen; however, there are a few general rules that are useful in dealing with all prospective customers. Their adaptation and use, successfully, depend entirely on the individual.

We have often likened the service business to the profession of medicine; however, we have the one drawback—that we don't bury our mistakes. But in presenting our sales talk we can learn much from the "professional manner." We, as do doctors, deal with people who know practically nothing of the subject about which we must talk. Therefore, our success depends not upon a brilliant technical discussion which would appeal to a fellow-workman, but upon the impression we make upon our customer.

Our first impression on the customer is, of course, our appearance. Now, admitting that there are a few people who are favorably impressed by the appearance of hard labor, we think it safe to say that 95% of the people prefer a service man who is neat and cleanly dressed. It will cost a little more in cleaners' bills, but the result will be well worth while.

Everyone likes to feel he is receiving special attention, and making customers feel that the "chief engineer" of the company is servicing their refrigerators is flattering. But, in addition to personal appearance, be neat about your work. Keep your tools clean and lay them out in good order. Above all things, avoid the appearance of a "blacksmith mechanic." You are a specialist called in to correct trouble in the refrigerator. Think well of yourself and your profession. Your appearance and manner will do more to sell your service than all the talking you can do.

While we are on the subject, it might be well to mention that you'll never make a good impression by "knocking" a competitor. If you can't say something good about him, say nothing at all.

We'll assume you have made a favorable impression on this hypothetical customer. You've diagnosed the trouble and must sell him on ordering the work done. Any customer wants to know just what you are asking him to spend his money for. Explain it as briefly as possible. Avoid technical discussion. Be sure you're right and then it will be easier to convince the customers. It's possible it may be a job on which you can quote two prices, depending on the quality of material used. Remember that the easiest way to sell is to have what the customer wants. However, you can help him

to decide just what kind of a job he wants done. Point out the advantages of a better job, but avoid argument. Don't antagonize the customer, above all things. You can't win an argument with a customer. Keep him on your side. Convince him that you are suggesting a job which you would order yourself if your positions were reversed.

It has been said that anyone can be sold anything if the proper sales technique is used. This may be stretching it a bit, but there is more truth than fiction in this saying. But of all the various sales methods, none is more convincing than faith in what you're selling, and in your ability to deliver the goods. Promise less than you will deliver rather than more. There is no more certain method of assuring future business.

* * *

SUPPLY AND PARTS MAKERS FORM NEW ASSOCIATION

AT a meeting held in Chicago Tuesday, December 10, the Refrigeration Supply and Parts Manufacturers Association was officially organized. A constitution and by-laws were presented, officers elected, and plans for creating better industry practices were outlined and discussed. Frank J. Gleason was named executive secretary with offices at 2707 David Stott Bldg., State and Griswold Sts., Detroit. The membership fee will be $50 a year.

A committee from the National Refrigeration Supply Jobbers Association met with the parts manufacturers and offered a series of objectives which they hoped the parts manufacturers will attain in their relations with the jobbers, and they promised full co-

operation with the new association.

One of the objectives of the new association will be the exchange of views on problems of mutual interest among the members. In particular, it is planned that members will be given an opportunity of exchanging, through the office of the Association, information on sales policies of common interest. To facilitate this, a committee will be appointed representing the various groups of products, and this committee will try to correlate sales policies of all the members with the idea of developing uniform practices.

The following officers were elected:

Officers

President, J. D. Colyer, Wolverine Tube Co., Detroit, Mich.

Vice-president, John S. Forbes, Kerotest Manufacturing Co., Pittsburgh, Pa.

Secretary-treasurer, H. V. Higley, Ansul Chemical Co., Marinette, Wis.

Board of directors: K. B. Thorndike, Detroit Lubricator Co., Detroit, Mich.; C. M. Brown, Tecumseh Products Co., Tecumseh, Mich.; Edward Gammie, Victor Mfg. & Gasket Co., Chicago, Ill.; R. W. Kritzer, Peerless Ice Machine Co., Chicago, Ill.; F. U. Webster, Cutler-Hammer, Inc., Milwaukee, Wis.; F. L. Riggin, Jr., Mueller Brass Co., Chicago, Ill.; Charles W. Johnston, Virginia Smelting Co., West Norfolk, Va.; D. H. Daskal, Perfection Gear Co., Harvey, Ill.

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ERMSTAT APPOINTS DISTRIBUTORS

THE Ermstat Company of Philadelphia, Penna., has recently announced the appointment of new distributors to handle the Ermstat Electric Motor Overload Protector, which is fully automatic. In New York the Paramount Electrical Supply Co. will be the distributor; in Pittsburgh, Williams & Co., Inc., and in Chicago the Borg-Warner Service Parts Co. The Refrigeration and Power Specialties Co. of San Francisco has been appointed a distributing warehouse.

PERFECTION ACQUIRES TRICO COMPRESSOR SERVICE

PERFECTION Refrigeration Parts Co., Harvey, Ill., recently purchased the manufacturing division of Trico Compressor Service, Chicago.

Through this acquisition, Perfection has taken over the manufacture of compressor seals, flapper valve plates, seal faces and other refrigeration compressor replacement parts formerly made by Trico.

In commenting on this step to further round out the line of Perfection Certified Parts, D. H. Daskal, president, reported an instantaneous and favorable reaction from the trade.

Perfection patented flapper valve plates incorporate fewer parts and assure positive seat. The construction of the valve and retainer is such that the valve is self-seating. Design permits the disc to revolve and constantly seat itself. No lapping or fitting is required, and quietness in operation is another of many features.

Perfection compressor seals are self-contained. They are quiet, cause no seal squeak and are self-aligning. Noted for long life because of lower spring pressure and elimination of bellows.

Replacement Seal Faces

Other new items taken over by the purchase of Trico include replacement seal faces. These faces, now made by Perfection, eliminate the necessity for relapping shaft shoulders, and in all cases do away with need of removing the shaft. These seal faces are available for ⅝" shafts, and can be used with any standard compressor seal. They are made of special hardened steel, highly lapped, and are quickly and easily installed—using a Duprene gasket to prevent leakage.

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Lee Sunderhaus,
Ohio.

Attached is money order for $2.00 for renewal of subscription to your wonderful journal which always has been a source of valuable information for service men.

REFRIGERATION SERVICE ENGINEERS' SOCIETY

Official Announcements of the activities of the National Society and Local Chapters appear in this department as well as articles pertaining to the educational work of the Society.

THE OBJECTS OF THE SOCIETY

To further the education and elevation of its members in the art and science of refrigeration engineering; with special reference to servicing and installation of domestic and small commercial equipment; for the reading and discussion of appropriate papers and lectures; the preparation and distribution among the membership of useful and practical information concerning the design, construction, operation and servicing of refrigerating machinery.

ASSOCIATION HEADQUARTERS: 433-435 North Waller Ave., CHICAGO, ILL.

THE OPEN ROAD

By **W. HALL MOSS**
President Memphis Chapter R.S.E.S.

ATTENTION refrigeration service men. The crude muddled lanes along which the refrigeration service industry has been traveling through the past years is now gradually taking a newer and brighter outlook. We hope before long to be upon smooth pavements so to speak, and we can if *all service men will* help each other.

There were many narrow and distorted paths and trails that were available and used by the many individuals which composed this new service industry, each living in his own realm of ecstasy and fantastic dreams of assured livelihood and success. The forethought of sane and sensible avenues upon which to travel on their journeys, which unknowingly would require the balance of their lives, was not taken into any consideration. Under such conditions each service man became his own road builder.

Thus your own lone and weary pilgrimage down the service road brought forth many disheartening obstacles. When your progress on a straight path was blocked in any way, it was a simple matter to change your course. It made no difference. An axiom applied in geometry, "A straight line is the shortest distance between two points," can be applied to the refrigeration service industry. But most of the service men thought that such an application was beyond thought, as they supposed that the refrigeration industry was too big to be governed by such "simple and silly principles." They thought that there was a "pot of gold" at the end of the Rainbow—Service Calls—and each individual was determined to arrive there before any one else and secure the whole pot for his own use. They thought that if upon the occasion of their migration they encountered another person engaged in the same trek towards that pot of gold, it was of course obvious that it was impossible to work with each other and build the road together. Each had his own plans and each was certain that his ideas were correct, so each person created a detour in their journey when their paths met with another. There resulted from this system of road building a massive network of imperfect roads and detours, all of which led in the end to nowhere. It seemed that the more efforts put forth, the more tangled the situation became, which clearly exemplifies the state of the refrigeration service industry.

If one disarranges one small gear in a massive piece of machinery its efficiency is impaired, if not entirely destroyed. All of us know that a mass of detours on a journey will obviously increase the time element in reaching our destination and the expense of the trip. In planning a trip of any great distance we all study the maps and select the road best suited to meet our requirements for the trip, and thus you lay definite and sane plans before you start the journey, because if you do not the trip cannot be successful. In this instance, our trip that we plan is a very long one — throughout our

lives—and we hope to make it a most successful one. So in order that we can come nearer making the trip as successful as we hope to make it, there arises the necessity of cooperating with others who hope to travel this same *successful road of refrigeration service.* Their good will and cooperation will enable each of you to start building a paved road, which can be finished through this sharing of expenses, at a much less expense on the part of each individual than if each one tried to build his own personal road. Also, bear in mind that the going will be much smoother.

There still remains the "pot of gold" at the end of the road and you will find that through the sharing of experiences, expenses, and through cooperation you will be able to reach that which you could not have reached if depending upon your individual efforts, over your expensive individual roads and detours. Even granting that after a long time you could reach the "pot of gold" over your individual road and detours, you must realize that owing to the increased expenses you were put to in building your own road and traveling over the many detours and accounting for the additional time required to reach your journey's end, you would not realize as much net profit as would have been realized by cooperation with others.

Be sure and pave a wide, smooth highway and see that it is firm. Let each of you who plan to journey down through the years participate in its construction, working together in perfect harmony and peace.

You ask how such can be done! Through organization such a road can be built, for organization is the means which will provide the necessary balance in maintaining moderation, security, and stability. It is a sure way to pave a sound, secure, firm, and straight road upon which the profession may travel, not only for the duration of your own lives, but for posterity, so that your children may continue to engage in this profession with the assurance of deriving therefrom a livelihood befitting a professional man and an American.

So let's fall in step and go forward.

AN EXPENSE SHARING SERVICE ORGANIZATION FORMED IN MEMPHIS

A NEW service organization along somewhat different lines from the usual has been formed in Memphis, Tenn.

The Associated Refrigeration Service, located at 943 Madison, was organized by Messrs. A. R. Black, W. C. Easley, B. A. Moore and W. Hall Moss. These men, members of the Memphis Chapter of the R.S.E.S., rented the building at the above location and made agreement between themselves and Memphis Chapter to share equally the expenses of rent, heat, telephone, lights and janitor service.

In other words, the four service men are associated together, sharing all expenses of renting and operating a place of business, yet each of them conduct their service operations as separate individuals, and the Memphis Chapter has a permanent address and club room where members can meet any day of the week, as well as hold their regular meetings.

It is planned to build up a reference library of books and magazines on refrigeration.

Memphis Chapter is desirous of hearing from any manufacturers who can supply engineers to lecture on any refrigeration subjects at any time during the coming year. Manufacturers are also requested to send service manuals, technical data on their equipment, parts catalogs, etc.

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DETROIT CHAPTER

Meeting of December 18, 1935

By* J. E. PERRY, *Secretary

5309 Hamilton Ave., Detroit, Mich.

THE regular meeting of the Detroit Chapter was held at the United Motors Building at Second and Milwaukee Avenue, and was called to order at 8:30 P. M. by 2nd Vice-president Mercier. The minutes of the meeting of December 4 were read by Secretary Perry and approved as read.

Mr. Mercier introduced Mr. McCarthy, Mr. Craddick and Mr. Lalond of the Westinghouse Company, who were visitors for the evening.

A letter was read by the Secretary from the Ranco people completing arrangements for a lecture we are to have on Feb. 5th.

Nominations were then opened for the executive offices of the Detroit Chapter. Mr. Murphree and Mr. Perry were nominated. Mr. Perry gave a resume of his recent trip to Chicago, his request regarding membership, etc.

Nominations were then postponed until the first meeting in January.

Mr. Tudhope made a motion to take $60.00 from the Treasury and pay it on account to Mr. Neudeck as a retainer.

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MEMBERSHIP BUTTON

AN attractive lapel button is now available for members of the R.S.E.S. This button, one-half inch in diameter, is attractive in appearance and finished in enamel colors with the initials and name of the Society legibly engraved thereon. The price of the button is $1.00 and it can be obtained from national headquarters.

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ST. LOUIS CHAPTER

Meeting of December 12, 1935

By* E. A. PLESSKOTT, *Secretary

2145 67th St., St. Louis, Mo.

THE regular meeting of St. Louis Chapter was held at the Crunden Library, Thursday, December 12, and was called to order by President Gray.

The minutes of November 14th were read and approved.

Having had no meeting November 28th, considerable correspondence had accumulated. This was read by the Secretary and the changes proposed by the Educational and Examining Board were discussed briefly.

President Gray advised all that the election and installation of officers would take place January 9, and asked them to make a special effort to attend. A Nominating Committee has been appointed and will make their recommendations at that time. President Gray expressed the desire that if possible an entire new set of officers be elected.

Mr. Gray outlined some of the proposed educational activities for 1936, and promised some information real soon on a membership drive.

PITTSBURGH CHAPTER

Meeting of December 9, 1935
By **F. V. GOLITZ,** *Secretary*
1518 Davis Ave., Pittsburgh, Pa.

THE regular meeting of Pittsburgh Chapter was held in the Corporation Room of the Commonwealth Building on December 9 at 8:00 P. M., President C. O. McCauley presiding.

The attendance amounted to about sixty, and President McCauley welcomed the visitors and spoke of the gratification of the officers for the large attendance.

The minutes of the November meeting were accepted as read by the Secretary. The correspondence was read and discussed; particularly that relating to the future meetings and the Credit Bureau. Members were asked to return the questionnaire to the Secretary as soon as possible.

Due to lack of time further business was deferred until the next meeting.

President McCauley introduced Mr. J. D. Merkle of the Automatic Reclosing Circuit Breaker Company, who in turn introduced the local representative of Ranco—Mr. Barker—and Mr. Joe Hipps the genial parts man from the Williams Company.

Mr. Merkle covered the history and construction of Rancostats thoroughly. At the conclusion of Mr. Merkle's lecture each member was given a copy of the Ranco Service Manual. Both the service manual and the lecture received the approval of the assembly.

CHICAGO CHAPTER

Meeting of December 10, 1935
By **H. D. BUSBY,** *Secretary*
5611 Lawrence Ave., Chicago

THE meeting was called to order at 8:45 P.M. Officers present were: Messrs. Jacobsen, Roth, Skipple, Busby and Forman.

The minutes of the previous meeting were read and approved.

Visitors for the evening, introduced by President Jacobsen, were Mr. Johnston of the Virginia Smelting Company, Mr. Martin and Mr. Phalen of the Uniflow Corporation.

Mr. Martin spoke briefly on the products manufactured by the Uniflow Corporation and offered his cooperation to the extent of

supplying the Society with any literature it may require on their products.

Mr. Spielman of the Ranco people gave an interesting talk on the latest developments in cold controls, distributing manuals among the members.

President Jacobsen announced that since the regular meeting date falls on Christmas Eve there will be no meeting until January 14th, at which time the annual election of officers will take place.

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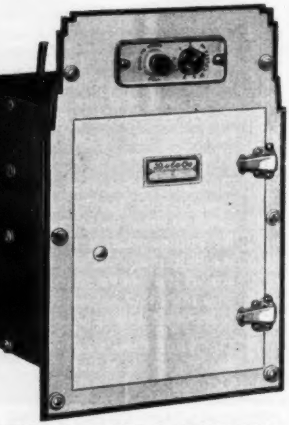
DOLE REFRIGERATING COMPANY INTRODUCES NEW DOMESTIC EVAPORATOR

THE Dole Refrigerating Company of Chicago, pioneers in the refrigeration field and inventors of the DoleCo Patented Vacuum Cold Plate, have just introduced a new type of evaporator for use in any domestic refrigerator.



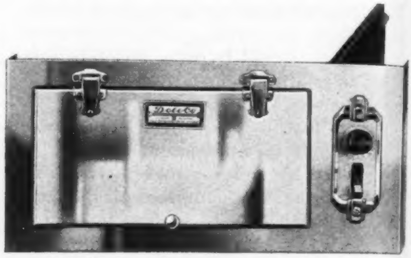
NEW TYPE OF DOLE EVAPORATOR

According to Mr. E. J. Tweed, treasurer and general manager of the Dole Refrigerating Company, these new evaporators should prove an innovation in this field. Mr. Tweed also stated that these evaporators have been perfected and thoroughly tested and have been found to be most efficient and can be supplied to the refrigerating service engineer at extremely reasonable prices.

The company claims that, realizing the importance of sanitation, they have concentrated their efforts in perfecting an evaporator which would be sanitary in every respect with no projections, corners or undesirable angles where slimes and odors might collect.

These evaporators can be supplied in attractive porcelain and beautiful hot sprayed finishes, all of which are entirely rust proof.

According to an experimental test which the Dole Refrigerating Company had made by the Ingersoll Steel & Disc Company, these evaporators were subjected to a salt spray test, 15% salt solution being allowed to spray continuously on the samples submitted in an apparatus constructed according to the



HORIZONTAL "L" TYPE DOLE EVAPORATOR WILL ACCOMMODATE TWO SHALLOW TRAYS, VERY EFFICIENT IN THE SMALLER BOXES.

U.S. Navy specifications. The test was begun on June 5 at 4:00 P.M. The sample was turned over at the end of 48 hours and again at the end of 72 hours. Inspections of the weld for corrosions were made at periodic intervals. At the end of 96 hours the sample was removed from the salt spray and no evidence of rust could be found. The Ingersoll Steel & Disc Company claim that there is no doubt but that the submitted sample is rustless and an accelerating test of this nature, over a period of 96 hours, would show any tendency of the sample to rust.

Full information and literature concerning these DoleCo Patented Vacuum Evaporators can be obtained by writing to the manufacturers direct.

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FEDDERS SALES MEETING

THE annual mid-winter sales convention of Fedders field representatives was held at The Fedders Factory in Buffalo, Thurs-

day, Friday and Saturday, December 26, 27 and 28. Representatives covering all territories from New York to Texas were in attendance during the three-day program.

The first day's sessions were devoted to engineering discussions presided over by L. C. Smith, executive engineer, and Joe Askin, chief engineer.

The 1936 sales and advertising plans were presented on Thursday by H. E. Rieckelman, Assistant to the President; W. D. Keefe, Sales Manager Refrigeration Division, and Horace Laney, Advertising Counsel.

Saturday was devoted to personal conferences with engineering and sales executives covering specific engineering and sales developments.

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SIMPLOGRAPH CALCULATES REFRIGERATION REQUIREMENTS

WESTINGHOUSE has taken the mystery out of the application of commercial refrigeration through the invention of the Simplograph. Due to the complicated nature of the commercial refrigeration business requiring the compilation of refrigeration loads and the selection of condensing units and coils, the business presented itself in a rather intricate form because it was necessary to those selling equipment to have a thorough knowledge of the manufacturers' methods in making the proper applications.

With the new Simplograph, it is a comparatively simple matter to select accurately, within a few minutes, the proper refrigeration equipment for various sizes of reach-in cabinets, walk-in coolers and the various

types of display cases which comprise the vast majority of the commercial refrigeration applications.

In order to place the average dealer in a position to take advantage of the opportunities in the commercial refrigeration business, Westinghouse has spent a year in research and a large sum of money to develop and perfect this Simplograph. This new method allows the representative making the estimate to select the proper refrigeration equipment with five simple easy steps.

Step No. 1: The fixture temperature is subtracted from the room temperature and this differential is set in a window on the front of the Simplograph by moving the inside slide into proper position opposite the type of service.

Step No. 2: Referring to the tables on the Simplograph covering for the proper type of fixture, a key number is selected under the thickness of insulation and opposite the size of fixture.

Step No. 3: Then referring to tables appearing at the foot of the Simplograph, the B.t.u. load per hour is obtained for this fixture, which is a total refrigeration load.

Step No. 4: Then turning the Simplograph over, the figure nearest this B.t.u. load is set in the B.t.u. load window and a key in the form of a proper symbol between the condensing room temperature and fixture temperature is secured.

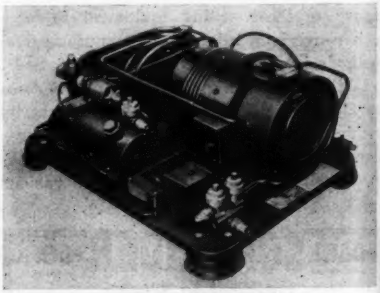
Step No. 5: Referring to the window under coils and units, look opposite this symbol and secure the proper unit and coil required for the fixture. Thus by two simple settings on the Simplograph, the operator is able to determine the proper refrigeration equipment necessary for the job.

This Simplograph has a decided advantage over the old method since it not only saves a great deal of time spent in estimating, but it eliminates any possibility of error through incorrect calculations, according to Westinghouse commercial refrigeration engineers. In addition the Simplograph is an effective helper in getting prospects interested and closing the sale. It saves the salesman's time, enabling him to make more calls and to make these calls more effective. The salesman can impress upon his customer that the recommendations made through the Simplograph are not his but the result of a systematic compilation that has been proved to be highly accurate through its successful use in hundreds of applications of every type, and that these recommendations are recommendations made by experienced factory engineers.

HERMETICALLY SEALED CONDENSING UNITS

THE Westinghouse Electric & Manufacturing Company announces the addition of a new model to their now existing line of hermetically sealed commercial condensing units. This new model, known as the WFB—33H and designed for the use of water as a condensing medium, uses Freon as the refrigerant.

By the use of this new unit, applications are now able to be made that in the past were impossible. Due to the hermetically sealed construction, it is possible to water cool the compressor, condenser and motor. This feature permits the installation of this unit in closets, under counter or back bars, or in fully enclosed and out of the way locations. It is now possible to remove all the heat by the use of water, thus eliminating the necessity for ventilation, as has been required by units not hermetically sealed.



NEW WESTINGHOUSE HERMETIC COMMERCIAL

The small compact unit is 24 inches long, 18½ inches wide, 11⅝ inches high and can be built into a cabinet without the use of louvres.

The motor is a ⅓ hp. of the capacitor type, directly connected to the two cylinder compressor. The compressor has a bore of

1 inch and a stroke of $\frac{7}{8}$ inch. The motor and compressor are electrically protected by the Westinghouse Spencer thermostat which protects, shuts the motor off in the event of line trouble, and starts the motor after the trouble has passed.

The receiver on this unit is constructed of seamless steel tubing with welded end heads. The end head is equipped with a fusible plug to protect the entire system from explosion in case of fire. The fusible plug has a discharge temperature of 280° F. This receiver is charged with four pounds of liquid Freon at the factory and has a pull down capacity of six pounds. This permits the addition of two pounds when the application requires, without the use of an additional receiver.

The new unit embodies also all the features of the standard air cooled hermetically sealed unit in the Westinghouse line.

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QUESTIONS AND ANSWERS

(Continued from page 23)

tity of oil in the evaporators, they will not refrigerate properly. I have had experience on two Peerless systems which had trouble with oil in their evaporators and in both cases, in repairing the compressor it was found that the rings in the lower part of the piston were stuck so that they did not seal the lower part of the piston in the cylinder. In this type compressor the pressure in the crank case varies very little. When the machine shuts off at the low pressure, the pressure in the crank case is higher than the suction pressure. When the system pressure is high and the system is about to start, the pressure in the crank case is lower than the suction pressure; that is, the pressure in the crank case will average somewhere between the cut off pressure and the cut on pressure. If the lower rings in the pistons do not work, as the suction pressure is reduced to a pressure lower than the crank case pressure, oil splashing up in the crank case will tend to be drawn into the refrigerant but I have never known an oil bound evaporator to be found in one of these systems where the lower piston rings were working properly. The upper part of the cylinders are usually dry and have a high polish, like glass.

The newer construction in compressors having the suction valves and discharge valves both in the cylinder head has a number of advantages, one I believe being simplicity in construction in that the piston is considerably simpler; and another, of course, is the reduced oil pumping that occurs in this type of construction.

In some of these, the suction side of the head is connected by an opening into the compressor crank case. This will allow a certain amount of oil pumping; as when the machine has its off period, the pressure in the suction line (and thereby the crank case) is increased and the oil in the crank case absorbs some of the vapor refrigerant. When the machine starts and the suction pressure in the crank case is reduced, the vapor comes out of the oil; and if the suction pressure is reduced rapidly, the oil will foam and this foam will carry up into the suction side of the head and be pumped through the system. However, this oil pumping is not nearly as serious in this type of compressor as in the case of one having the inlet into the compressor crank case; because the vapor does not come into contact with the oil which is splashed around by the connecting rod of the compressor.

Want *Information*?

Use The R. S. E. SERVICE DEPARTMENT

—It's for Your Convenience

THIS department is conducted for the convenience of our subscribers. We will ask the manufacturers and distributors to send you the latest information on the items checked.

☐ Belts
☐ Blow Torches
Blowers (see Unit Blowers)
☐ Books
☐ Brushes, Motor
☐ Bushings, Motor
☐ Carbon Tetrachloride
☐ Charging Hose
☐ Charging Stand

Coils
☐ Fin
☐ Pipe

☐ Compressors

Condensers
☐ Air Cooled
☐ Water Cooled

☐ Condenser Water Regulators
☐ Connecting Rods

Controls
☐ Cold
☐ Humidity
☐ Liquid Level
☐ Pressure
☐ Temperature
☐ Thermostatic
☐ Water

☐ Domestic Evaporators

Dehydrants
☐ Activated Alumina
☐ Calcium Chloride

☐ Dehydrators
Door Seals (see Gaskets)
☐ Drums, Service
☐ Dryers

Evaporators
☐ Dry
☐ Flooded
☐ Fan and Pulley Assemblies

Filters (see Strainers)
☐ Float, High Side
☐ Float Valve Seats

Fittings
☐ Flared
☐ Streamline

Gaskets
☐ Compressor
☐ Door
☐ Gasket Material
☐ Gasket Tackers
☐ Goggles
☐ Gauges, Service
☐ Hardware, Refrigerator
☐ Leak Detectors
☐ Lapping Compound and Materials
☐ Liquid Indicator
☐ Lubricating Oils
☐ Low Side Float Switches
☐ Low water
☐ Motors
☐ Needles, Float Valve
☐ Oil Return

Packing
☐ Fabric
☐ Metallic
☐ Piston Pins
☐ Piston Rings
☐ Porcelain Refrigerator Cement
☐ Pumps, Circulating
☐ Receivers

Recording Instruments
☐ Humidity
☐ Running Time
☐ Temperature

Refrigerants
☐ Sulphur Dioxide
☐ Methyl Chloride
☐ Carrene
☐ Freon
☐ Iso Butane
☐ Ethyl Chloride

Refrigerator Dishes
☐ Glass
☐ Porcelain
☐ Safety Masks

☐ Seals, Shaft
☐ Resurfacing Stones
Strainers
☐ Expansion and Float Valve
☐ Liquid Line
☐ Suction Line

Switches
☐ Air Temperature
☐ High Pressure Control
☐ Low Pressure Control
☐ Pressure
☐ Temperature
☐ Mercury

Thermostats
☐ Air Temperature (Cooling)
☐ Air Temperature (Heating)
☐ Brine
☐ Domestic Refrigeration
☐ Industrial Refrigeration

Thermometers
☐ Refrigerator
☐ Test
☐ Tool Chests

Tools
☐ Flaring
☐ Pinchoff
☐ Tube Bender
☐ Tube Cutter
☐ Wrench Sets
☐ Trap, Scale
☐ Trays, Ice Cube

Tubing
☐ Copper
☐ Finned
☐ Steel
☐ Tinned
☐ Unit Blowers

Valves
☐ Automatic Expansion
☐ By Pass
☐ Check
☐ Compressor
☐ Expansion
☐ Flapper
☐ Magnetic
☐ Pressure Reducing
☐ Shutoff
☐ Solenoid
☐ Thermostatic Expansion
☐ Two-Temperature
☐ Water
☐ Valve Retainers
☐ Valve Stems

Write in Names of Products Not Listed

Name ....

Address ....

City and State .. ..

Business ....

Mail This Page to the

Refrigeration Service Engineer 433 N. Waller Ave., Chicago, Ill.